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ABSTRACT

New programs offer fresh opportunities to create new careers with potential for disadvantaged adults to grow and develop. This publication describes some practical ways to view jobs in determining whether to restructure to form new opportunities. The process of task analysis involves identification of the duties, taks, and elements of the job content, description of the knowledges, skills, abilities, and decisions prerequisite to successful learning and performance of job task, and establishment of the specific, precisely-stated job-related performance objectives which provide directional content guidance and adequacy tests for training. Guidelines are provided for identifying and stating performance objectives, distinguishing and using job analysis terminology, and developing and testing the accuracy and thoroughness of a task list. The task list combines the tasks, behavioral objectives, and knowledges, skills, abilities, and decisions into a logical format. A related document is available as VT 012 080 in this issue. (SB)

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Reference File and the Disadvantaged *No. 6*

Task Analysis for training the Disadvantaged

NATIONAL CIVIL SERVICE LEAGUE, 1028 CONN. AVE., N.W. WASHINGTON, D. C. 20036

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NATIONAL CIVIL SERVICE LEAGUE

A public personnel system that is responsive to and relevant to its times—work for this ideal has been the National Civil Service League's mission since it started in 1818. The NCSL organized to halt the rampant corruption produced by the patronage system of government appointments.

When a disgruntled office seeker killed President James A. Garfield in 1881 the country became as alarmed as the national leaders—such as Theodore Roosevelt and Carl Schurz—who founded the NCSL. Spurred by NCSL leadership, Congress passed the first national civil service law—a law drafted by the League—which decreed that public appointments were to be made according to the applicants' merits.

Over the years, the League has fought for better government via the installation of the merit system nationwide. Today we point proudly to the 36 state governments plus hundreds of cities and counties which now hire according to merit.

The League continues to serve as a chief spokesman and mentor of the merit system. We stand for it, and we speak to its flexibility to meet public challenges and to provide a public personnel system that is truly relevant to today!

In recent months, the League has turned its attention to two areas of national concern: the growing shortage of personnel for government jobs, and the need of the disadvantaged for meaningful, "real" jobs. The League believes that each of these problems carries the other's solution. Yet civil service systems often seem designed purposely to frustrate the hiring of would-be employees.

The League believes that rules and regulations designed to facilitate the merit system in the 1890's or the 1930's do not necessarily serve the 1970's. Further, the League knows that many jurisdictions around the country—state, county and city—want to revise their personnel structures to fit today. But how, and in what direction?

It is to provide such leadership relevant to this age that the League developed a new project: Public Employment and the Disadvantaged. The League is working with public and private leaders in cities, counties and states to help bring the disadvantaged into public employ.

JANUARY, 1970

The writing and publication of this article constitute part of a League project, Public Employment and the Disadvantaged, which is financed by a contract with the Department of Housing and Urban Development.

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Task Analysis for training the Disadvantaged

HIRE FIRST and TRAIN LATER CONCEPT

The hire first—train later concept is directed toward resolution of the continuing paradox of a shortage of skilled, or professional, personnel in many occupational fields and an abundance of unemployed and under-employed people in the general population. Specialists and professionals, in perhaps all occupational fields, often perform tasks which do not require extensive training and education. In many of these occupations, manpower needs go unmet, in part due to unnecessarily high credentials required for employment.

Jobs in the medical, nursing and engineering professions have been successfully sub-divided, in past years, in manners which have created hierarchies of career opportunity. Educators and social workers are in the process of broadening their occupational career ladders. Because the broad area of community and public services is now experiencing significant growth, particularly in the urban communities where large numbers of entry-level employees are available, it is natural to ponder solutions of mutual benefit.

To achieve desirable social goals, we must recognize that a major problem in the effective utilization of the disadvantaged is motivation, and that few people are motivated by dead-end jobs. The proper analysis of work, the creative rearrangement of work elements into "career ladder" jobs with a future, and effective training of people to fill these jobs are systematic ways of challenging, preparing and using the performance potentials of disadvantaged trainees.

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TASK ANALYSIS: Gateway to Job Structuring and Training

This publication describes, as "task analysis," some practical ways to view jobs in determining whether to "re-structure" to form new employment opportunities.[1]

Task analysis:

- Identifies the duties, tasks and elements of job content.
- Provides detail for identifying the KSAD statements (Knowledges, Skills, Abilities and Decisions) prerequisite to successful learning and performance of job tasks.
- Makes possible the expression of specific, precisely job-related performance objectives which provide directional/content guidance and adequacy tests for training.

Developing programs, such as the Model City Administrations, offer fresh opportunities to create new careers, to increase potential for disadvantaged adults to grow and develop in productive work, and provide opportunities for successful training and on-the-job performance of work dedicated to public benefit.

TASK ANALYSIS: Basis for Performance Objectives

Instructional programs, too frequently, include irrelevant content, omit required content, misplace emphasis, and ultimately produce under-trained or over-trained "graduates." The fault of these programs is their failure to identify—and prepare trainees to attain—specific objectives of instruction.

Job and task analysis can be used to avoid costly waste of time and resources in training and, further, to assure that the training prepares the trainees to meet the performance objectives of their post-training jobs. Too often, the objectives of training programs have been stated vaguely; they should be stated in clear, specific terms. Training objectives such as the following are open to any number of different interpretations: "... to provide the student with a general knowledge of ...," "to provide a working knowledge of ...," "to furnish an understanding of ..." Clearly, such vaguely-worded aims do not provide the direction and guidance required to develop instructional materials or to construct valid standards of performance. If precise training is to be provided, objectives must describe clearly what the man *must be able to do*, the *conditions* under which he must be able to perform, and the *standard* or criterion *of acceptable performance* at critical points during the development of job skills and at the end of the training program.

When identifying training objectives, it is helpful to differentiate training from education. Education is the broader process oriented toward more comprehensive understanding and aimed at preparing the student for complex decisions or interpretation of new relationships. Training is specific and performance-oriented; its results should be directely related to observable behavioral patterns. While training and education are interrelated and their differences are often ones of scope, training tends to be more short-ranged and specific, while education is more fundamental and lasting. Training must be efficient, as its purposes are specific and its results are exactly measurable. Training must prepare "graduates" who attain functional behavioral objectives. These objectives can best be identified through task analysis techniques.

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[1] See National Civil Service League Reference File *How to Structure Job Tasks for Training the Disadvantaged.*

LEVELS OF JOB DATA

Basic Structure of Jobs

A basic structure, common to all jobs, makes it possible to develop and apply a standardized method of studying jobs. The term "job" is applied to a particular unit in the hierarchy of work done to produce goods and services. The work hierarchy has at its base the work operations a single worker performs in doing a portion of his job: the discrete motions, mental processes and movements. Its upper limit is formed by the work operations accomplished by groups of individuals combined into organizations.

Various names are given to the units that compose this range of work operations for the production of goods and services. Figure 1 shows the interrelationships between job, duty, task and element units.[2]

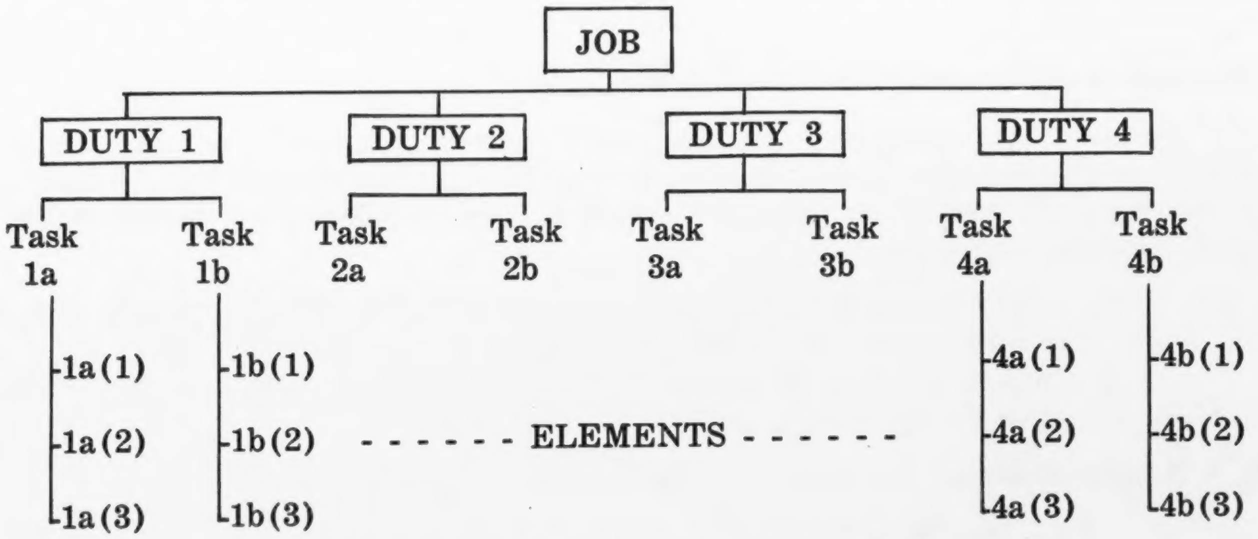

Figure 1. Interrelationships of job, duties, tasks and elements.

Job Analysis Terminology

Job. The duties and tasks performed by one man constitute his job. Several individuals hold the same job if they perform identical duties and tasks. A job is the unit with which the personnel transactions of selection, training, classification and assignment are usually carried out.

Duty. A job is made up of one or more duties. A duty is a large segment of the work done by one individual, often a major subdivision of the work content of his job. A duty is recognized, usually, as being one of the principal job responsibilities. It occupies a reasonable portion of the worker's time, occurs with reasonable frequency in the work cycle and involves work operations which use closely related skills, knowledges and abilities.

A duty is performed for some purpose, by some method, according to some standard with respect to speed, accuracy, quality or quantity. The performance standard may have been determined by the job-holder through trial and error or as a result of experience, or provided by the supervisor in the form of oral, written or graphic instructions. Duties may be considered as major or minor, depending upon the extent to which they establish demands for skills, knowledges, aptitudes, physical capacities and personal traits, and upon the percentage of total worktime involved in their performance. Duties are also frequently characterized by the consequence of error, a measure of the significance of decisions made on the job.

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[2] Personnel departments frequently use the term "job description" to identify a written work analysis of a job and its duties. Job descriptions are normally too generalized to be useful in specifying behavioral objectives required for efficient training.

Task. A task is a unit of work activity which forms a consistent and significant part of a duty. The tasks which constitute a job are not homogeneous units of behavior; they are logically differentiated segments of work activity. A task, then, has the same relationship to a duty as a duty has to a job. Each duty is made up of one or more tasks. Each task occupies a reasonable portion of the worktime spent in performing a duty, occurs with reasonable frequency in the work cycle of a duty, is performed according to some standard and involves very closely related skills, knowledges, abilities and decisions.

Element. An element is the most detailed level of work activity described in job analysis. Tasks are made up of elements. Elements are the smallest steps into which it is practicable to subdivide any work operation without analyzing separate motions, movements and mental processes involved. An element is a meaningful and useful grouping of these basic work units. It is the work unit that deals with the details of how the methods, procedures, and techniques involved in a task are carried out.

Example of job analysis terminology in use

An example of the appropriate level of job analysis generalizations might involve the *job* of building equipment maintenance repairman, such as a workman employed to service equipment in an apartment project. His job description might include, among others, these duties:

1. Apply preventive maintenance routines to all blowers and fans in heating and air conditioning units according to Service Manual A20K.
2. Inspect filters of all heating and air conditioning units monthly and replace as required or at time of conversions.

A task statement for duty 1 might include:

a. Disable power supply.
b. "Lock out" equipment.
c. Remove guards and cover plates.
d. Identify lubrication points from diagram 187 in Manual A20K.
e. Select oil of proper SAE rating for the coming season, according to chart 49 in Manual A20K.

It is at this point that a *knowledge* of power supplies and "locking out" procedures, as well as skills in tracing diagrams, comes into play. The basic prerequisite, *ability* to read, is also a factor.

An element statement for task c ("Remove guards and cover plates") might be:

1. Remove four screws with allen wrench.
2. Grasp plate by tabs.
3. Rotate to right until released.
4. Pull plate straight out.

Simple as element 1. may be ("Remove four screws with allen wrench"), it is the first level at which an identifiable *skill* appears. It is not, however, practical for determining training objectives to analyze work into finer units than the element level, as doing so would involve motion-type analysis.[3]

For some jobs, it may be difficult to draw precise boundaries between duties and tasks, or tasks and elements. When this happens, use of the more detailed category is best.

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[3] Motion analysis, such as reach 10", grasp allen wrench, move 6", position over the set screw, etc., indicates examples of units more detailed than the element level.

KSAD Statement Definitions[4]

The definitions of KSAD statements (Knowledges, Skills, Abilities and Decisions), the raw materials of which training courses can be constructed, illustrate their similarities with tasks and task elements. KSAD statement definitions, however, suggest that no direct correlation between them and jobs or duties should be made. Not every building equipment maintenance repairman, for example, may know what an allen wrench looks like (and which end to use). Similarly, the duty "apply preventive maintenance routines to all blowers and fans" does not, without KSAD search, indicate that the trainee must show knowledge and discretion in selecting a lubricant proper for the equipment and the season.

Knowledges. Knowledges define specific information a person must know or have available in order to satisfactorily perform a segment of a job. Knowledge of markings and conventions used in scale line drawings, for example, is needed in making drafting layouts.

Skills. Skills refer to the physical dexterity and controls a trainee must have to satisfactorily complete the various activities pertaining to a particular job segment. For example, in preparing an animated display, a technician may be required to lay out panel board sections; operate light wood-working machine tools; use paint airgun; and position, wire and adjust electrically operated animation units and sound tape units.

Abilities. Abilities define physical and mental attributes prerequisite to performance of a job segment. Examples of abilities, in this sense, are the ability to reach 7′ height, the ability to see an object of X size 300 yards away, etc.

Decisions. Decisions refer to the discretionary demands of the job, usually in terms of having to learn and make discriminations and decisions regarding job data. Classification and coding tasks provide on-the-job examples in many types of work.

PERFORMANCE OBJECTIVES FOR TRAINING

Special attention must be given to the difficult task of developing performance objectives for training.

A performance objective is a statement which clearly communicates an instructional intent, that is, it *describes a proposed change in the behavior of a trainee.* Three essential characteristics of a performance objective are that it must:[5]

- *Identify the terminal behavior.* The statement of an objective must identify exactly what the student must be able to do at the end of an instructional unit or complete course of instruction to demonstrate that he has achieved the required behavior. The terminal behavior involves the application of the trainee's learning.
- *Describe the conditions of performance.* The statement of a performance objective must describe clearly and completely the conditions under which the student must be able to demonstrate the behavior. The "conditions" part of an objective identifies what the man will be *given* to do the job (tools, equipment, job aids, references, materials), what he will be *denied* (tools, equipment, etc.), what *assistance* he will have, if any, what *supervision* will be provided, and the *physical environment* in which he must perform (climate, space, light, etc.).

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[4] Task statements frequently use the term "ability" in the sense of capacity to perform some task element, without splitting hairs over whether a knowledge or skill is required, e.g., "the ability to operate mechanical counters." The key factor is whether or not performance requirements can be precisely determined.

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[5] Robert F. Mager, *Preparing Objectives for Programmed Instruction,* Fearon Publishers, San Francisco, 1962, p. 12.

- *Set a criterion of acceptable performance.* The statement of a performance objective must describe *how well* the student must be able to perform. The criterion or standard establishes the minimum performance requirements for a job duty, task or element. To do this, the objective statement must prescribe the *quality* of the work product or service produced (accuracy, completeness, clarity, tolerances, etc.) ; the *quantity* of work products produced (the number of work units completed) ; the *time* allowed to complete the job, duty, task or element; or a combination of quality, quantity and time standards.

Development of an effective training program requires the specification of performance objectives based on the KSAD's inherent in the tasks to be done. Well-planned objectives will require minimal interpretation, while clearly expressing the objective.

Minimal Interpretation

A useful objective pictures clearly and concisely the learner demonstrating a specific desired behavior or behavior pattern. It must be a literal picture of performance which will be interpreted in the same sense by all training personnel in planning and conducting training activities.

Clear Expression

As in any communications media, the primary problem in writing objectives is to provide a common base of interpretation for a variety of readers. Vague or loaded words such as "know" or "appreciate" must be consciously avoided in favor of more explicit terminology. Again, the intent is to picture the trainee behaving or performing specific actions within desired parameters. If he must "know" something, what is the demonstrable behavior involved? In a more precise sense, is our objective really to enable him to write something based upon gained knowledge; or perhaps to construct, or rearrange, or compare certain variables utilizing a knowledge of certain principles? The requirement for clear expression is, in effect, a demand for objective, action-framed statements which draw a picture of the student behaving as a result of teaching. Consider the following examples of vague terms (Group 1) and the clearer expressions of instructional goals (Group 2).

Group 1: Vague terms

THE TRAINING OBJECTIVES ARE TO...

provide a general knowledge of...
provide a working knowledge of...
qualify...
know about...
understand...
develop an appreciation for...
be familiar with...
orient...
inform trainees of...
communicate skills for...

Group 2: Behavioral terms

FOLLOWING TRAINING, THE TRAINEE MUST...

calculate...
repair...
adjust...
modify...
classify...
install...
construct...
select...
differentiate...
equate...
assemble...
rearrange...
organize...

Often the simple expediency of considering training from the trainee's point of view ("After I learn this, I expect to be able to...") can help structure performance objectives.

DEVELOPMENT OF THE TASK LIST

The "task list" format collects together in a logical form the details about tasks (column 1), KSAD's (column 2), and behavioral objectives (column 3). The sections below discuss how to gather data for task lists, provide further description (and an example) of the task list format and, lastly, indicate how to check task lists for thoroughness and accuracy.

Methods for Gathering Data

Information from which tasks and task elements are identified is gathered by one of three methods: (a) interviews, (b) participants' logs, and (c) observation. Often a combination of the methods is used.

Interviewing

A task list is often initially developed through interviewing several people who are currently performing the job. The objective is to learn (and document) what they actually do on the job, day by day. Since people are often defensive about their jobs, the interviewer must obtain the interviewee's acceptance of the purpose of the study, and thus his understanding and willingness to cooperate. Several points about interviewing are important:

1. Interviews with several job-holders can quickly produce a unified list of work items for the job.

2. The interviewee is generally asked to describe in considerable detail, some specific duty that he has performed in the last day or two. This duty may involve the performance of a few or many tasks and task elements.

3. After the preliminaries (set a friendly climate and identify the duty to be discussed), a useful initial question might be: "How did you know that performance of the task was *completed?*" Typical responses might be: "I pushed the button and it worked," "The parts were produced to size," "The totals of the rental income column (c) on the ledger sheet, plus the monthly noncollectible balance (e), equaled the total of the projected monthly income column (f)."

4. One useful (but, perhaps, strange-sounding) technique is backward-chaining. The interviewee is asked to describe the *final* task performed (3 above), and then to describe the task completed just *before* that one, and then the task *before* that, etc., so that he relates details *backwards* through the performance of the duty until he reaches the *starting point* for the task (such as "received job order").[6] If an experienced person describes a chain of events in the order he performs them, familiarity with performance often causes him to rush forward and forget those tasks that are most automatic. Describing a sequence backwards, however, requires much more care and the task list is usually more complete. A little practice can make the interviewee comfortable with the technique; some people enjoy "the game" once they have started.

5. The interviewer often prepares a cover sheet for the task list to describe the interviewee's age, experience, prior training and education, working conditions on the job, special assignments, etc. These details may alert the interviewer to any special influences which may affect the task list.

6. As each job duty is described, a list of tools, equipment and devices used in performing tasks is identified. The tool list is one of the best methods of linking tasks described under one duty with those similarly performed under another duty. "Reading pressure gauges," for example, may use the same knowledges or skills in several jobs.

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[6] Backward-chaining is a part of an educational strategy known as mathetics, which deals with the principles of learning. (See reference in Bibliography.)

7. Data on the time required to perform a task is seldom useful for training purposes; attempts to collect it may connote time-study to some people. If timing is a *critical* performance factor pertinent to the training ("the tissue culture dies in 40 seconds"), it must be recorded as the trainee must learn to accomplish the task during the time in which performance is constructively possible.

Participants' Logs

The "log" technique for gathering task data differs from interviewing in that experienced workers are asked to keep daily logs (or lists) of the things they do during the day and of the tools and equipment they use. The technique is particularly useful for specialists and technicians. Several considerations are important in dealing with participants' logs:

1. Participants may require a careful introduction to the purpose of obtaining a log, and they may withhold cooperation or complain about the "extra work."

2. Log sheets are usually collected daily and compared to insure uniformity of approach (among participants) and to resolve discrepancies in the data recorded.

3. Some interviewing concerning the logs is usually required. Indication that the participant made several telephone calls, for example, is insufficient; interviewing should be conducted to determine what types of information were requested, received, recorded, given, etc.

4. Figure 2 shows a sample log form; a sheet of lined paper will ordinarily suffice. On the form shown by Figure 2, columns for listing start, stop and elapsed times are provided. The "Qty." column is used for noting the number of times the task is repeated successively within the elapsed performance time indicated.

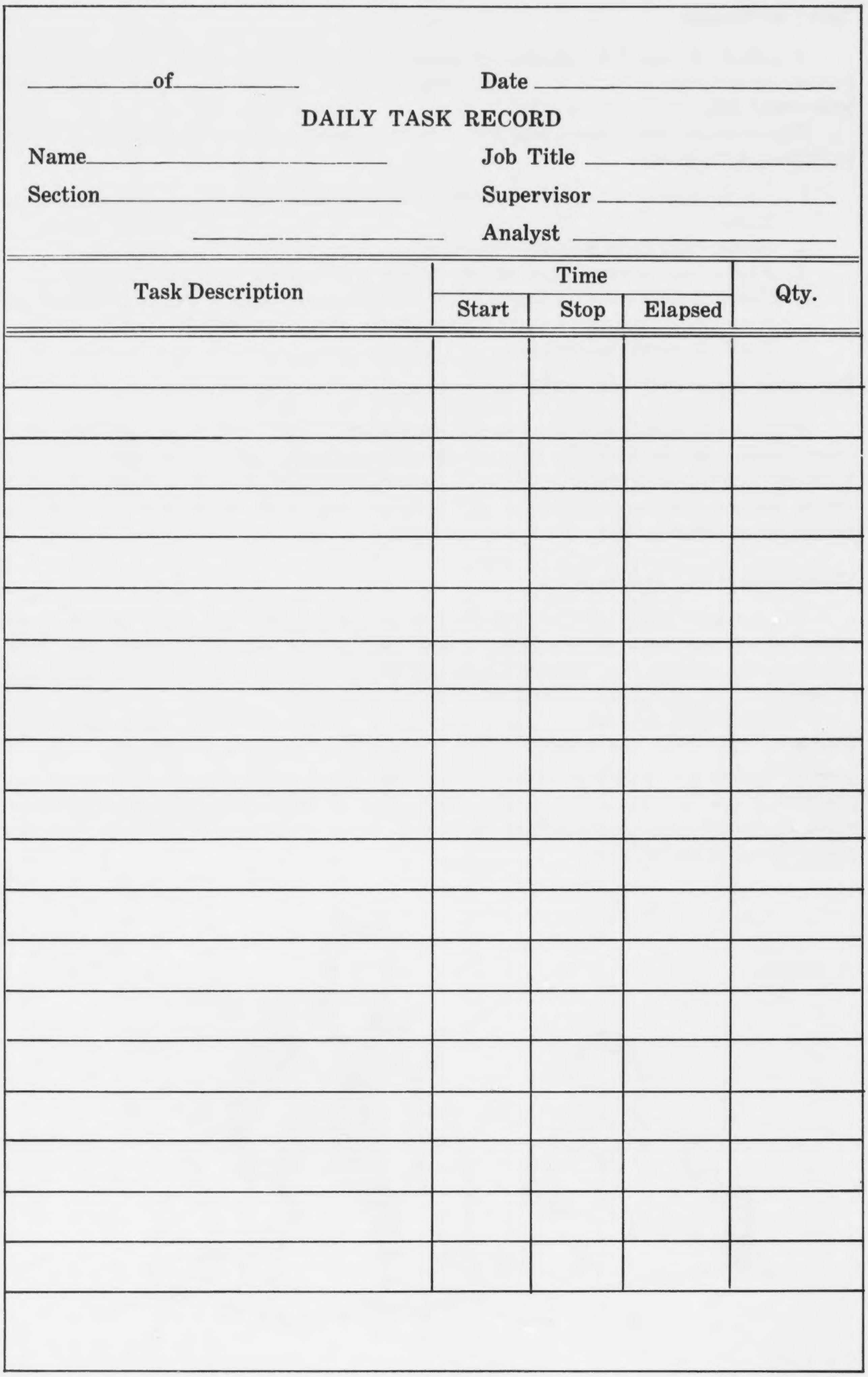
5. A rule of thumb for determining the dimensions of a *task* is that it generally takes more than 30 seconds and less than five minutes. The real test, of course, is the successful expression of the task in KSAD training statements.

6. Task logs can be kept for a day or several weeks, depending on the complexity of the duties and the frequency with which unusual tasks occur. The less repetitive the job, generally the longer period required for logging tasks.

When several people with similar jobs are filling out task logs, meetings to review the findings will help to standardize terms and task content. Individuals may also be helped to visualize their jobs differently as a result of these discussions; they may begin to realize that they do some work that does not require their full range of skills—this helps, of course, to identify tasks which may be delegated or re-structured in new career job ladders. Group meetings frequently aid in obtaining objectively-stated job contents, thus deflating attempts to exaggerate job requirements (KSAD's).

Observation

Watching a job-holder go about the performance of his job and recording the tasks, tools, equipment, etc., is the most time-consuming and expensive method of getting task data, but may offer the most thorough results. Sampling, which is discussed later, can be efficiently used to identify tasks, but the requirement for instantaneous observation in sampling requires that other methods of gathering job information must be combined with it.



________ of ________ Date ________

DAILY TASK RECORD

Name ________ Job Title ________

Section ________ Supervisor ________

________ Analyst ________

Task Description	Time			Qty.
	Start	Stop	Elapsed	

Figure 2. Participant's Log Sheet.

Task List Format

A variety of task list formats are possible. The example in Figure 3 shows one format which may be used to record tasks (column 1), KSAD's (column 2), and behavioral objectives (column 3).

The example entry-level position (urban planning data collection aide) could include such tasks as:

1. *Conduct* personal surveys (asking questions and recording answers on survey forms).
2. *Obtain* data from published records.
3. *Photograph* areas (types and conditions of dwellings, rental units, etc.)
4. *Conduct* observational surveys of structures and grounds (of broken windows, damaged shrubs, etc.) and *check off* items on survey sheets.
5. *Conduct* verbal interviewing and opinion-surveys (using tape recorder, etc.)

Two other tasks ("01" and "02") are indicated by the Figure 3 example.

This set of tasks would not require very much formal education (perhaps sixth grade level); people with less than average intelligence could be quickly trained to perform such tasks. Also, since the task elements, KSAD's, and behavioral objectives are so precise, the construction of performance standards to measure job success would be reasonably easy.

Thoroughness and Accuracy

The actions taken to insure that a task list is complete and accurate can range from that of having a professional review the list and add (or revise) any items appropriate, to preparing a several-step questionnaire process involving surveying of hundreds of craftsmen in several building trades.

The principal purpose of the validation is to insure that *all* tasks have been identified, including the erratics. The frequency with which tasks occur and the level of worker who performs them may also require confirmation. Frequency of task performance is important for on-the-job training of the disadvantaged—where possible, frequently-done tasks would be taught first, to accelerate participation and productivity of the trainees.

ENTRY LEVEL TASKS FOR
POSITION OF

Urban Planning Data Collection Aide

TASKS	KSAD'S	BEHAVIORAL OBJECTIVES
01 *Count* people, cars, trucks, etc., passing a specific location in a specified time period and *record* tallies on data collection sheets.	**Ability to operate those hand-held mechanical devices for counting possessed by employer.** **Knowledge of how to set and re-set alarm-type wrist watch for specific timing periods.** **Decide on method of locating self in relation to subjects to permit accurate counting.**	**Given a specific location, count people, cars, trucks, etc. (selected for study) which pass a spot in specified time periods within ± 2% accuracy.** **Record tally figures in premarked locations on survey sheets.** **Set and re-set alarm-type wrist watch according to verbal instructions or times indicated on survey sheet.**
02 *Distribute and collect* questionnaires to homes, stores, churches, business establishments, etc., in a specific geographic area (questionnaires to be filled out by recipients).	**Knowledge of how to read street names, building numbers, and name cards in typed, printed, or handwritten form.** **Decide if person contacted is a responsible adult.**	**Given a set index cards listing business or family names and street names and number locations, contact resident or proprietor to distribute survey forms.** **Collect forms and indicate receipt of such on index cards.** **Amend index cards if the occupants have changed or premises are vacant.**

Figure 3. Example of Task List.

Survey Methods

A tentative task list may be submitted to several workers who were not involved in the original information-gathering body. These workers are frequently asked how often, on the average, they perform the tasks; whether the task is relatively new or is becoming obsolete; and if they can add any items to the tentative task list. If needed, the preliminary task list is revised and the revised task list, in turn, is then submitted to a larger number of workers to get a valid sampling of all the people occupying a specific type of job.

Sampling

Statistical sampling observational techniques may be used to provide, for a given effort, sampling results approximately equal to those derived from costly, continuous observation. Sampling in this context is a scientific method of instantaneous observation on a random basis to get information about tasks being performed. If the sampling is scientifically conducted, the degree of accuracy in specifying job behavior can be predicted within a specified range.

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